Ocean Acidification: What Corals Can Tell Us

Many people are familiar with sea level rise and ocean warming, but ocean acidification?

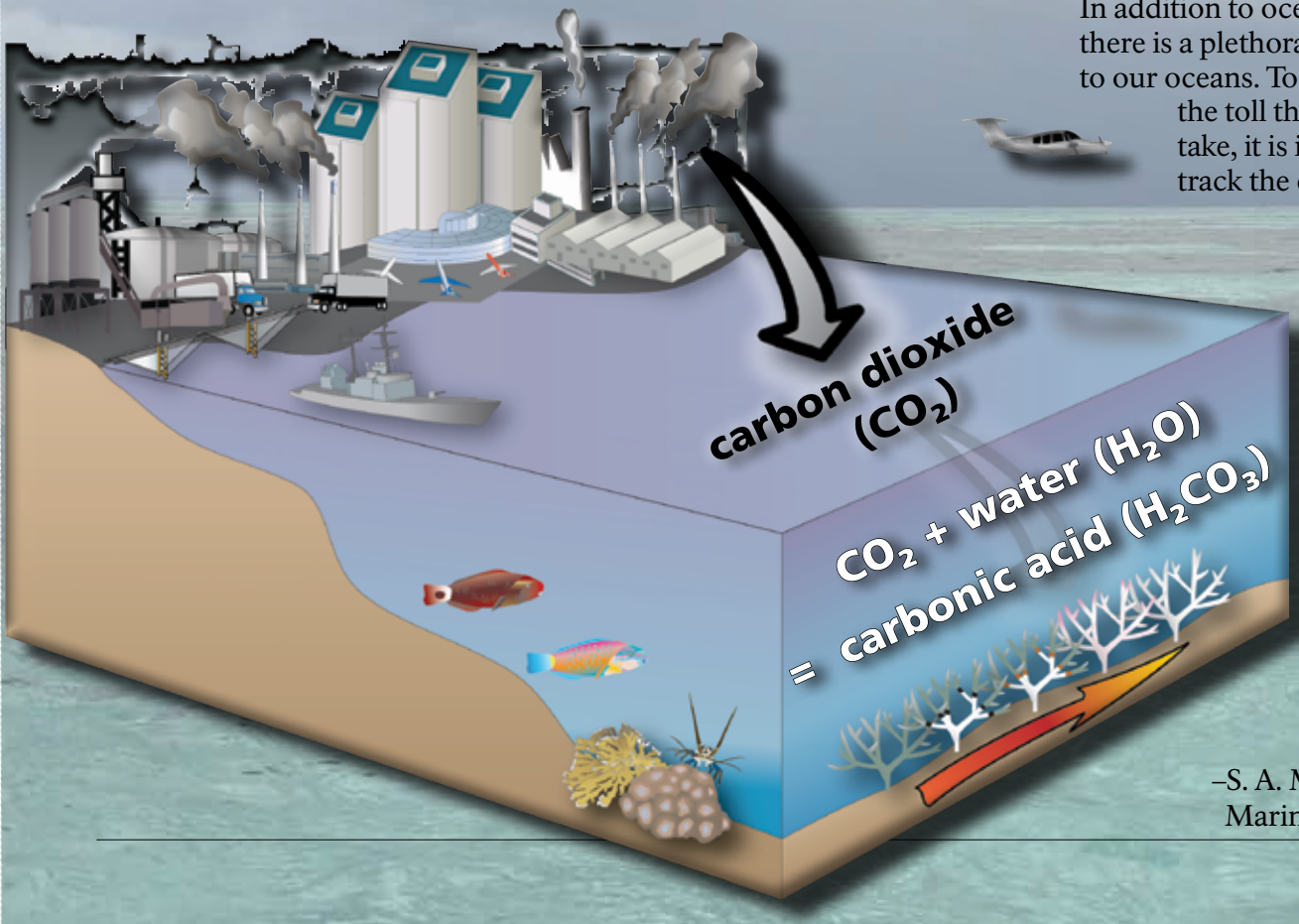
Just as carbon dioxide from the burning of fossil fuels ends up in our atmosphere, it also ends up in our oceans, resulting in a process called ocean acidification. The carbon dioxide (CO_2) dissolving in our ocean combines with seawater (H_2O) to make carbonic acid (H_2CO_3) (see illustration).

Ocean chemistry is changing fast. The measure of the acid-alkaline balance is pH, from 0, extremely acidic, to 14, extremely alkaline (7 is neutral). On this scale, an increase or decrease of 1 unit is a tenfold change. The current ocean pH is around 8.0 but surface pH has decreased by 0.1 since 1750, and a further decrease of 0.3-0.4 units is projected to occur by 2100. While these may seem like small changes, the reality is that ocean pH normally changes extremely slowly over vast periods of time, giving organisms time to evolve. This rate of change means that by 2050, the ocean could be more acidic than at any point over the last 20 million years.

So why care? Have you ever seen what acid rain does to buildings and sculptures? It gradually dissolves the limestone resulting in blemished pillars and melted faces. The corrosive effects of acid rain on these limestone/calcium carbonate structures is similar to the effects on marine life which also uses calcium carbonate (e.g. seashells, urchins, and corals), with a scary exception... Sculptures can be restored. In nature, that is not possible. The chemical process of acidification reduces the building material (carbonate ions) needed by marine organisms to construct their skeletons and shells, while simultaneously dissolving their already existing shells and skeletons. Furthermore, the energy that corals and other organisms expend to build and maintain shells or skeletons is increased, making the conditions even more difficult to endure. It is no wonder that ocean acidification has been referred to as the "osteoporosis of the sea".

The effects of ocean acidification are not limited to just calcium carbonate utilizing organisms, but to all marine life. The changes in ocean chemistry result in other problems such as reduced metabolism and poor reproductive abilities for many species. As a consequence, fewer species in our oceans will survive.

In addition to ocean acidification, there is a plethora of other stressors to our oceans. To better understand the toll that these stressors take, it is important that we track the condition of our corals reefs to document how they change. The PACN Benthic Marine and Marine Fish programs monitor certain indicators of the health of coral reefs to see what corals and other organisms can tell us about threats like acidification.



–S. A. McKenna, NPS Marine Biologist